MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

HMB2011 – INTRODUCTION TO MOLECULAR BIOLOGY

(All section / Groups)

12 OCTOBER 2019
2.30 p.m. – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **4 pages** with **5 Questions** only.
2. Attempt **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.
4. You can use calculator in the examination.

Question 1

(a) Name at least THREE reagents needed for PCR and the function of each. [3 marks]

(b) You decide to use PCR to determine if you have cystic fibrosis, a genetic disorder. You then decide to also check if you are at risk for developing Alzheimer's disease, another genetic disorder. What PCR "ingredient" would be different in these two tests?

[0.5 mark]

(c) In principle, what outcome would be expected in a failure to separate pre-PCR and post-PCR activities? [0.5 mark]

(d) Estimate the annealing temperature for the following primer: (Please show the calculation steps)

T A A C C G C G C A [1 mark]

(e) DNA purification is considered to be of vital importance for most methods involved in molecular biology, genomics, biotechnology and clinical research. What is the purpose of purifying DNA samples? [1 mark]

(f) What is the molarity of a solution prepared by diluting 0.180L of 0.6M solution A to 540mL? (Please show the calculation steps) [1 mark]

(g) A solution of DNA has a concentration of 0.025mM. What is its concentration expressed as pmol/μL? [1 mark]

(h) What is the molarity of a solution made by dissolving 6.057g of Tris in sufficient water to make up a solution of 500.0mL? (molar mass of Tris = 121.136 g/mol) (Please show the calculation steps) [2 marks]

Continued...

Question 2

(a) What is polycistronic mRNA? [1 mark]

(b) Explain how attenuation assures that expression from the *trp* operon is off when tryptophan is present. [2 marks]

(c) Compare and contrast the *cro* and *cI* genes. [2 marks]

(d) What is an untranslated region? What are the functions of the 5' UTR and 3' UTR? [3 marks]

(e) What is RNA interference? Why is it important? [1 mark]

(f) What is the role of dicer? [1 mark]

Question 3

(a) Answer TRUE or FALSE for each of the statements below. If the statement is TRUE, explain or give a supporting example. If the statement is FALSE, either correct the statement or give a counter example. [5 marks]

i. Mutation of the phage λ *cII* gene would lead to lysogeny.

ii. P_{RM} is a promoter for repressor transcription.

iii. Enhancers are regulatory sites that are next to the promoter.

iv. Stop codons signal the end of the polypeptide chain during translation.

v. Silencer is protein capable of binding other transcription regulation factors to repress gene expression.

(b) What is frameshift mutation? What could result in a frameshift mutation? [1 mark]

(c) Describe how acridine dyes cause frameshift mutations. [0.5 mark]

(d) Describe the phenomenon of photoreactivation repair. [1 mark]

(e) What human condition is caused by unrepaired UV-induced lesions? [0.5 mark]

(f) What will happen if failure of DNA repair system in our body? Give TWO examples. [2 marks]

Continued...

Question 4

(a) Briefly explain, how the homologous recombinant differs from the site-specific recombination. [2 marks]

(b) Describe a general process of a typical transposable element in mutant corn. (Diagram is not compulsory) [2 marks]

(c) List THREE factors that affect hybridization experiment. [3 marks]

(d) What is the difference between primer and probe? [1 mark]

(e) What is the purpose of RNA sequencing? [1 mark]

(f) How does RNA sequencing work? [1 mark]

Question 5

(a) How can recombinant DNA be identified? Give THREE methods. [3 marks]

(b) What advantage is it to have a polylinker region (multiple unique restriction sites) incorporated in the *lac*Z component in the pUC series of plasmids? [1 mark]

(c) Why are knockout mice used extensively in human research? Give THREE reasons. [1.5 marks]

(d) Cytogenetic map is visual appearance of chromosome when you examined under the microscope. Give THREE information you can get from human cytogenetic map. [1.5 marks]

(e) What are contigs and scaffolds in the DNA sequencing technology? [1 mark]

(f) How does Illumina next generation sequencing work? [2 marks]

End of paper